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(54) Striking implements.

(57) A striking implement comprises a handle portion (8) and a striking portion, in which the striking implement is discontinuous in that it comprises two parts (9,10) one part including the striking portion and the other part including the handle portion (8) or a part thereof, the said two parts (9,10) having complementary formations (12,13) which are assembled to overlap axially with a vibration-damping material (11) interposed between and bonded to said formations (12,13), whereby the two parts are inseparably connected together but the vibration-damping material (11) mechanically isolates one from the other.

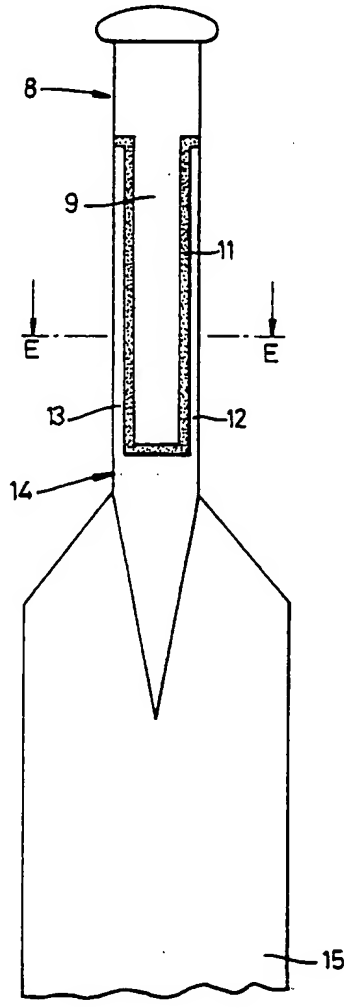

Fig. 9

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This invention relates to a handheld striking implement which includes a vibration-damping element isolating the portion which is held from the portion used for striking.

Although the present invention will be described with particular reference to a games racket or a cricket bat it is not to be construed as limited thereto as it is applicable equally to other striking implements such as sports equipment e.g. hockey sticks, golf clubs, baseball bats, hurley sticks, polo sticks, croquet mallets, and also batons, truncheons and shillelaghs.

The present invention provides a striking implement which comprises a handle portion and a striking portion, in which the striking implement is discontinuous in that it comprises two parts one part including the striking portion and the other part including the handle portion or a part thereof, the said two parts having complementary formations which are assembled to overlap axially with a vibration-damping material intersposed between and bonded to said formations, whereby the two parts are inseparably connected together but the vibration damping material mechanically isolates one from the other.

Preferably the complementary formations assemble so as to constitute a substantially identical cross-section to that of the remainder of the handle portion. Examples of complementary formations are:

(i) two, three or more fingers which interdigitate when assembled,

(ii) a cone and socket, and

(iii) a pin and socket.

The axial overlap of the complementary formations means that the confronting faces extend in planes angled to each other and in a preferred embodiment these planes are substantially perpendicular to each other. Where the complementary formations are substantially identical but merely rotated through 90° in the final assembly it is possible and convenient to mould in one piece hollow handle portions with formations, cut through the formations, rotate one of the handle portions 90° and then assemble the complementary formations. The assembly must be suitably jigged to align the components prior to the vibration-damping material being injected to fill the gap between the said complementary formations.

The vibration-damping material may suitably be a thermosetting or a thermoplastics material and especially an injectable material, for example a polyurethane resin. A suitable material may be based upon an elastomeric material compounded to produce the properties of a vibration-damping material.

A preferred polyurethane resin comprises an injectable thermosetting elastomeric material particularly in the form of a two-part, curable polyurethane which is mixed in liquid form and can therefore be readily injected and subsequently cures in situ. Such a material is available from Compounding Ingredients Limited as CILCAST 101 (which is cured by the addition of CILCURE B). The words CILCAST and CILCURE are Registered Trade Marks. (The hardness and resilience of the vibration-damping materials are measured according to British Standards (B.S.) tests which are internationally available and familiar to the skilled artisan). Such a material has the properties desirable for the vibration-damping material of the present invention being of a hardness greater than 60° SHORE A measured according to BS 2782 Part 3 "Indentation Hardness by Durometer (Shore A)" and resilience below 20% when measured according to BS 903 Part A8 Method B "Method for Rebound Resilience". More preferably the vibration-damping material has a hardness in the range 70 to 95° SHORE A measured according to BS 2782 Part 3 "Indentation Hardness by Durometer (Shore A)", the preferable resilience for the vibration-damping material being in the range 5 to 15% measured according to BS 903 Part A8 Method B "Method for Rebound Resilience".

Preferably the vibration-damping material is self-bonding to the complementary formations of the two parts of the striking implement i.e. no separate adhesive is required. The aforementioned two-part curable polyurethanes have this desirable property.

Preferably the handle portion includes only one discontinuity according to the present invention but the handle portion itself may be joined to the striking portion rather than being integral therewith.

The present invention is particularly applicable for use in a cricket bat where it is important for the handle to be light, strong and able to absorb at least some of the shock received when the striking portion (i.e. the blade) strikes a cricket ball. Preferably the part which includes the handle portion is designed so that the formations are substantially in a plane perpendicular to the face of the striking portion (blade) and thus the formations of the part which includes the blade are in a plane substantially parallel to the face of the blade. This arrangement will improve shock absorbency of the final product.

Particularly where the formation of one part consists of 2 or more fingers which interdigitate with the corresponding 2 or more fingers of the other part it may be preferable to provide a web between the fingers of one said part to reduce bending of the formations when the implement is used for striking and thus to reduce the strain imposed on the bond between the complementary formations. To take advantage of this potential improvement the web should be provided between the formations, the free ends of which will be nearer to the striking portion when the striking implement is in use.

Preferred materials for the handle portion are of fibres e.g. of carbon or glass impregnated with a thermosetting or thermoplastics resin. Such compositions can be moulded to give hollow, and thus light, strong handle portions. Particularly for striking implements where there is a high degree of shock in use, e.g. a

cricket bat or hockey stick, the fibres may be of material with increased shock absorbency properties e.g. aramid or polyethylene fibres.

The present invention will be illustrated merely by way of examples in the following description and with reference to the accompanying drawings in which:-

Figure 1 is a side elevation of part of a handle portion with two fingers according to one embodiment of the present invention;

Figure 2 is a sectional view along the line A-A of Figure 1;

Figure 3 is a side elevation of the part handle portion of Figure 1 assembled with and bonded to its complementary part handle portion;

Figure 4 is a sectional view along the line B-B of Figure 3;

Figure 5 is a side elevation of part of a handle portion with three fingers according to a second embodiment of the present invention;

Figure 6 is a sectional view along the line C-C of Figure 5;

Figure 7 is a side elevation of the part handle portion of Figure 5 assembled with and bonded to the complementary handle portion;

Figure 8 is a sectional view along the line D-D of Figure 7;

Figure 9 is a front elevation of a cricket bat according to a further embodiment of the present invention;

Figure 10 is a sectional view along the line E-E of Figure 9.

Figure 11 is a side elevation of part of a handle portion with two fingers joined partly by a web according to a further embodiment of the present invention;

Figure 12 is a side elevation of part of a striking portion with formations complementary to those of the part handle portion of Figure 11; and

Figures 13 and 14 are side elevations of the part handle portion of Figure 11 assembled with, and in Figure 14 bonded to, the part striking portion of Figure 12.

Referring to Figures 1, 2, 3 and 4 a part handle portion 1 has formations (fingers) 2 and 3. The part handle portion 1 is hollow and made by wrapping layers of resin impregnated fibre in fabric or 'warp sheet' form around an inflation tube and then moulding under heat and internal pressure, as is well known to those skilled in the art of making hollow articles from polymer composite materials. Alternatively the inflation tube may be replaced by a plastic material capable of expanding under the action of heat to produce the necessary internal consolidating pressure. Fibre alignment of the wrapping layers is chosen to produce the desirable directional strength in the handle portion, and the fibre type may be chosen to produce desirable properties of enhanced shock absorbency over and above that provided by the vibration-damping material interposed between the complementary formations. Such fibres with good shock absorbency are glass fibres, aramid fibres and polyethylene fibres, and such fibres may be used in combination with each other or with carbon fibres to achieve the desirable properties. A part handle portion 4 is made in the same way and has formations 5 and 6 (which lies behind formation 3 in Figure 3). The complementary formations (fingers) of these two part handle portions are assembled so as to interdigitate and vibration-damping material 7 is injected between the said formations. When the vibration-damping material 7 sets it bonds to the formations. Thus the part handle portions are mechanically isolated but strongly bonded by the vibration-damping material. Such an assembly may be used e.g. as part of a games racket.

Referring to Figures 5 to 8, the construction is of a very similar principle to that shown in Figures 1 to 4 but uses instead complementary formations of three fingers each.

Referring to Figures 9 and 10, a cricket bat which incorporates a further embodiment of the present invention consists of a part handle portion 8 with formations 9, 10 assembled with and bonded via a vibration-damping material 11 to complementary formations 12, 13 of part handle portion 14. The handle assembly is hollow and of consolidated resin impregnated fibre composite and is bonded to a wooden blade 15.

The main direction in which a cricket ball will strike is shown by the arrow F in Figure 10. In this arrangement the formations 9, 10 of the part handle portion 8 are in a plane perpendicular to the face of the bat and thus there will be improved shock absorbency compared to an arrangement where the formations 9, 10 are in a plane parallel to the face of the bat.

Referring to Figure 11, the part handle portion 16 has fingers 17 and 18 joined along part of their length by an integral web 19. Referring to Figure 12, the part handle portion 20 has fingers 21 and 22 (22 lies behind 21). The complementary formations (fingers) of the two part handle portions shown in Figures 11 and 12 are assembled so as to interdigitate as shown in Figure 13. Vibration-damping material 23 is injected between the said formations and then set to bond to the formations as shown in Figure 14. The arrow F indicates the direction of the force which will be experienced by the striking implement, whether it be a cricket bat or tennis racket, during use. Thus the web 19 resists the opening of the fingers 17 and 18 which would otherwise occur during use of the striking implement.

Claims

1. A striking implement comprises a handle portion and a striking portion, in which the striking implement is discontinuous in that it comprises two

parts one part including the striking portion and the other part including the handle portion or a part thereof, the said two parts having complementary formations which are assembled to overlap axially with a vibration-damping material interposed between and bonded to said formations, whereby the two parts are inseparably connected together but the vibration-damping material mechanically isolates one from the other.

2. A striking implement according to Claim 1 wherein the complementary formations each consist of at least two fingers which interdigitate when assembled.

3. A striking implement according to Claim 1 or 2, in which the vibration-damping material is a thermosetting material.

4. A striking implement according to any one of Claims 1 to 3, in which the vibration-damping material is an injectable material.

5. A striking implement according to any one of Claims 1 to 4, in which the vibration-damping material comprises an elastomer.

6. A striking implement according to any one of Claims 1 to 5, in which the vibration-damping material comprises a polyurethane.

7. A striking implement according to any one of Claims 1 to 6, in which the vibration-damping material has a hardness greater than 60° SHORE A measured according to B.S. 2782 Part 3 "Indentation Hardness by Durometer (Shore A)" and resilience below 20% when measured according to B.S. 903 Part A8 Method B "Method for Rebound Resilience".

8. A striking implement according to Claim 7, in which the vibration-damping material has a hardness in the range 70 to 95° SHORE A measured according to B.S. 2782 Part 3 "Indentation Hardness by Durometer (Shore A)".

9. A striking implement according to Claim 7 or 8, in which the vibration-damping material has a resilience in the range 5 to 15% measured according to B.S. 903 Part A8 Method B "Method for Rebound Resilience".

10. A striking implement according to Claim 1, 2, 3, 4, 5, 6, 8 and 9, in which the vibration-damping material comprises an injectable, thermosetting polyurethane elastomer and has a hardness of 70 to 95° SHORE A measured according to BS. 2782 Part 3 "Indentation Hardness by Durometer (Shore A)" and a resilience in the range 5 to 15% measured according to B.S. 903 Part A8 Method B "Method for Rebound Resilience".

11. A striking implement according to any one of Claims 1 to 10 in which the striking implement consists of two parts having complementary formations connected by means of vibration-damping material.

12. A striking implement according to any one of Claims 1 to 11 in which the vibration-damping material is self-bonded to the complementary formations without a separate adhesive.

13. A striking implement according to any one of Claims 1 to 12 wherein the complementary formations each consist of at least two fingers which interdigitate when assembled and one of the complementary formations of at least two fingers has a web connecting the fingers partially along the length thereof.

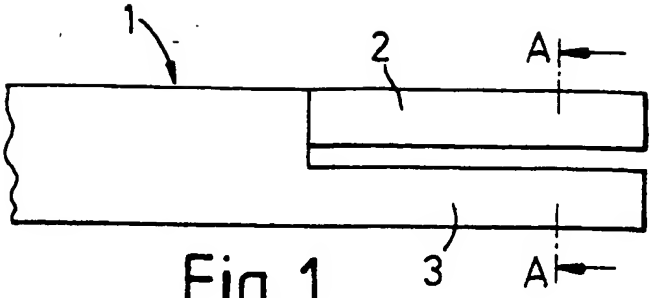

Fig. 1

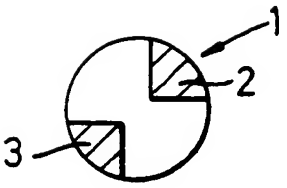

Fig. 2

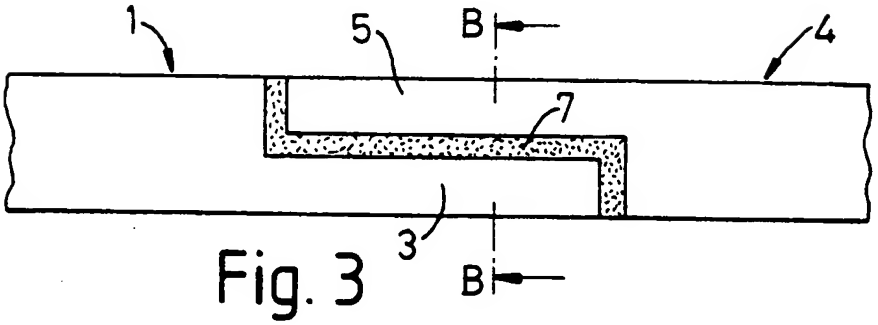

Fig. 3

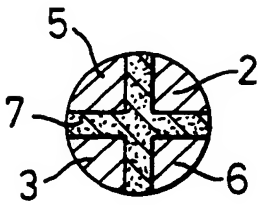

Fig. 4

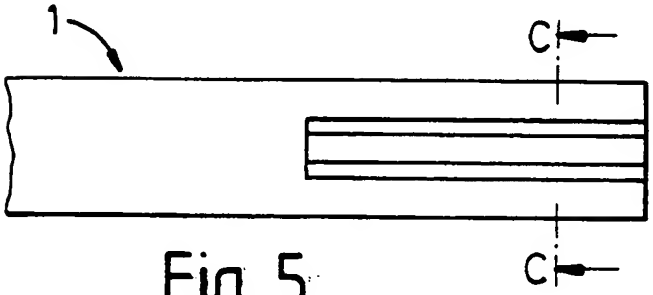

Fig. 5

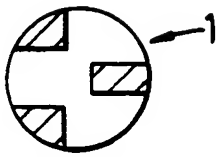

Fig. 6

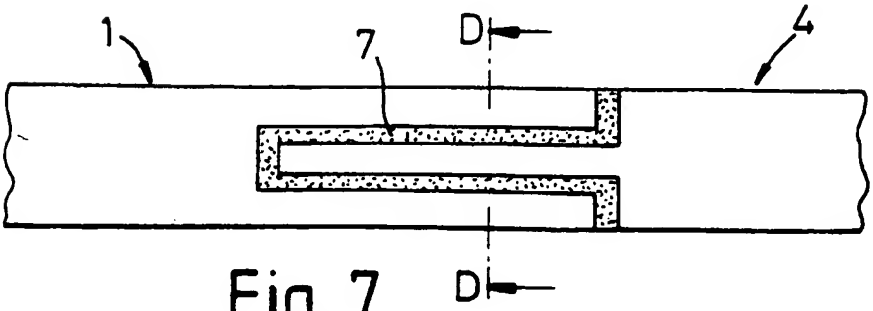

Fig. 7

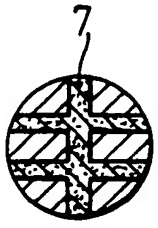

Fig. 8

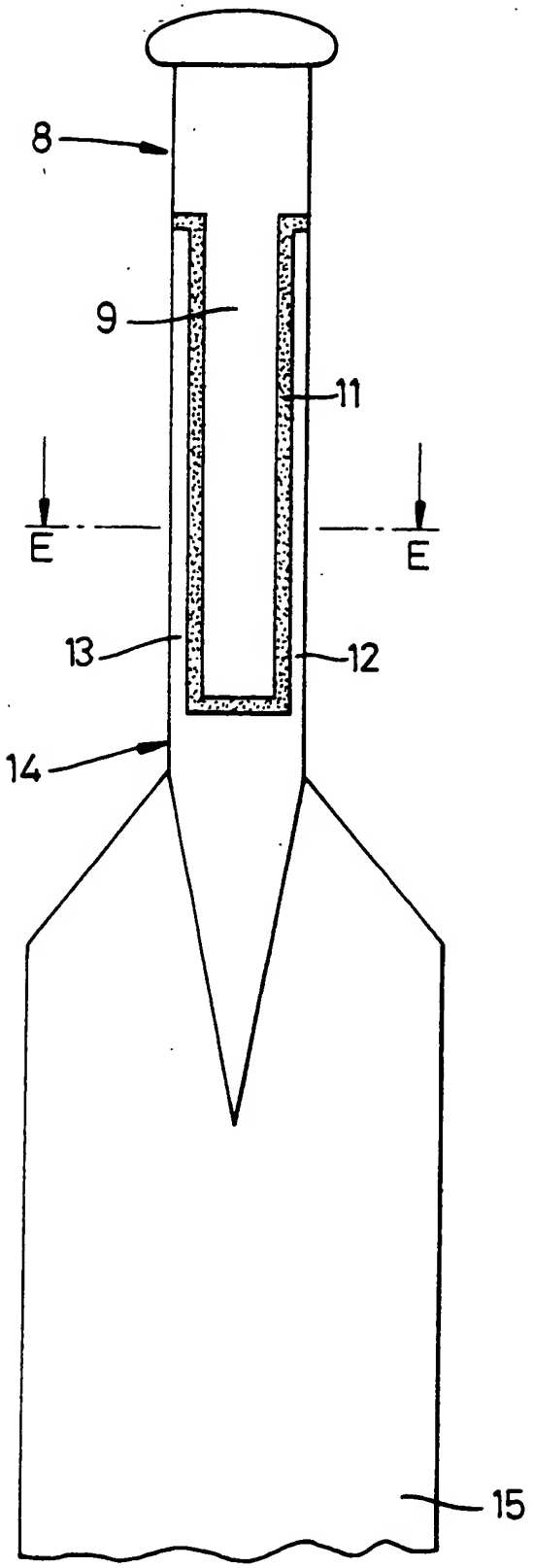

Fig. 9

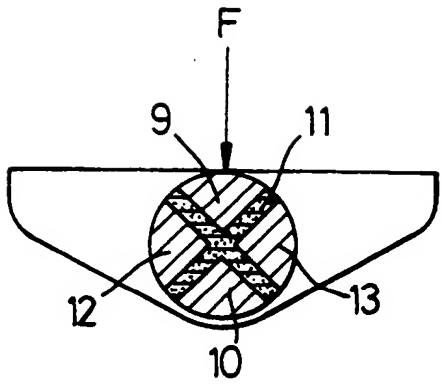

Fig. 10

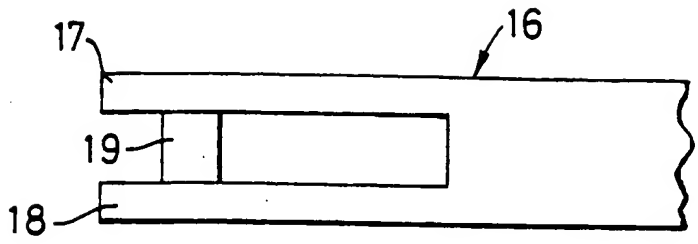

Fig. 11

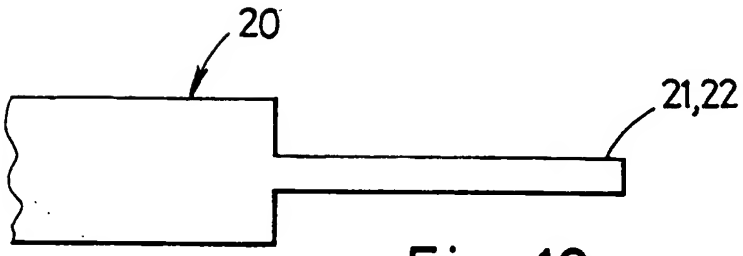

Fig. 12

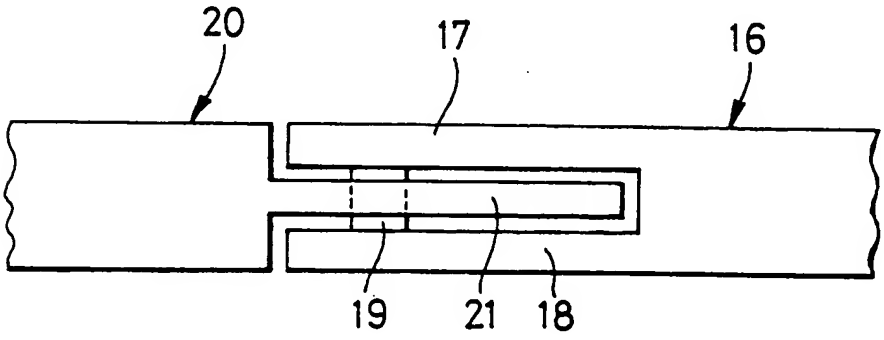

Fig. 13

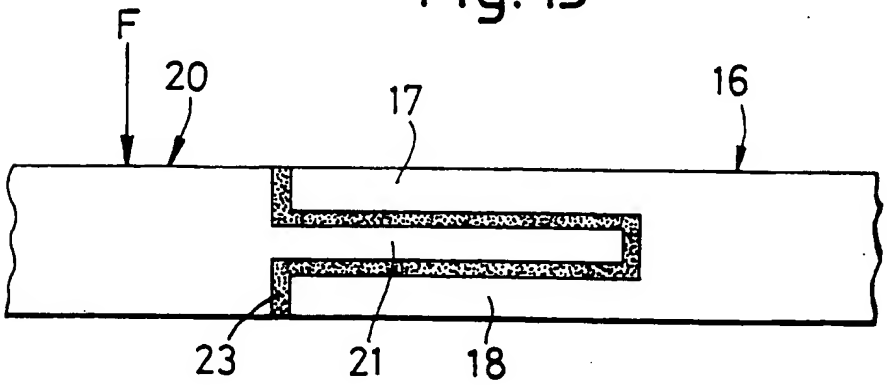

Fig. 14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 30 6298

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB-A-2 149 311 (TARR) * page 2, line 45 - page 3, line 33 * * page 5, line 11 - line 55; figures 1,5,6 *	1,3-6,11	A63B49/00 A63B59/00 A63B49/08
A	FR-A-827 983 (REGY) * page 1, line 46 - page 2, line 10; figures 1-4 *	1,2,13	
A	US-A-4 983 242 (REED) * column 3, line 19 - column 4, line 19; figure 2 *	1,3-6,12	
A	GB-A-2 230 458 (JUNG CHING PENG) * page 5, line 1 - line 17; figure 1 *	1,3-6,11	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5) A63B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	09 OCTOBER 1992	MONNE E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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